Determinants and effects of direct foreign investment in Cote d'Ivoire, Morocco, and Venezuela

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World Bank

1995

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The virtual disappearance of commercial bank lending to developing countries in the 1980s created a resurgence of interest in direct foreign investment. The need for alternative sources of capital, combined with an increasing skepticism about import-substituting trade strategies, led many developing countries to liberalize restrictions on incoming foreign investment. Some countries even tilted the balance toward foreign firms by offering special incentives: in the Czech Republic, joint ventures pay lower income taxes than domestic enterprises; in much of the Caribbean, foreign firms receive income tax holidays, exemptions from import duties, and subsidies for infrastructure.

Are such subsidies justified? Foreign investment may generate a number of benefits for the host country: by financing the expansion of business or the creation of new firms, it increases employment; it may lead to the transfer of knowledge or new technologies from foreign to domestic firms; and it may provide critical know-how to enable domestic plants to enter export markets. If foreign firms introduce new products or processes to the domestic market, domestic firms may benefit from the accelerated diffusion of new technology (see Caves 1982 and Helleiner 1989 for surveys on the transfer of technology). In some cases, domestic firms may increase their productivity simply by observing foreign firms in the region. Diffusion may also occur through turnover of labor, as employees move from foreign to domestic firms. If this spillover benefit is not completely internalized by the incoming firm, some type of subsidy could be justified. The expectation that foreign investment may serve as a catalyst for domestic production rationalizes policies in economies as

diverse as those of Bulgaria and Taiwan (China), whose governments offer special treatment for foreign firms in high-technology sectors.

Despite the voluminous literature on direct foreign investment in the 1960s and 1970s, the empirical evidence on spillovers from foreign sources of equity investment remains slim. This chapter draws on new data sources for Côte d'Ivoire, Morocco, and Venezuela to explore two related questions. To what extent do joint ventures or wholly owned foreign subsidiaries exhibit higher levels of productivity than their domestic counterparts? Does technology spill over from these foreign entrants to domestically owned firms?

The research reported here is the first to exploit panel data at the level of individual firms, which allows a more detailed comparison of foreign and domestic firms than was previously possible. The behavior of foreign and domestic firms can be compared by sector, controlling for firm-specific attributes such as size. The panel nature of the data also allows the analysis to go beyond the cross-sectional studies of the past, which compared partial measures of productivity (such as labor productivity) across sectors. The availability of data for several countries permits exploration of the extent to which the impact of foreign investment is a general or a country-specific phenomenon.

The analysis shows that in Morocco and Venezuela, firms with foreign equity participation pay higher wages, have significantly higher levels of productivity, and export and import more than their domestic counterparts. It also finds that the presence of foreign firms has no impact or a strong negative impact on the productivity of domestic plants in Morocco and Venezuela, in contrast to previous studies on the extent to which technology spills over from foreign to domestic firms. This negative effect is likely to be a short-run phenomenon, as foreign firms steal market share from domestic competitors and reduce their utilization of capacity. We also examine the response of domestic and foreign firms to trade liberalization in Côte d'Ivoire. The results suggest that productivity increases more in foreign than in domestic firms.

Characteristics of Foreign Direct Investment in Côte d'Ivoire, Morocco, and Venezuela

For 1987 the share of foreign direct investment in the manufacturing sector—defined as a weighted mean of foreign shares in the assets of a firm—was 7 percent in Venezuela, 14 percent in Morocco, and 38 percent in Côte d'Ivoire (see table 7.1). Though these shares may be overstated for Côte d'Ivoire and Morocco because the firm-level sample is incomplete (only the largest firms are included in the Côte d'Ivoire sample), they provide a notion of the magnitude of foreign investment.[1]

Table 7.1 Share of Foreign Direct Investment in Manufacturing in Côte d'Ivoire, Morocco, and Venezuela, 1975–89
(percentages)

Year	*Côte d'Ivoire*	*Morocco*	*Venezuela*
1975	67	—	—
1976	67	—	—
1977	61	—	—
1978	64	—	—
1979	54	—	—
1980	55	—	—
1981	54	—	—
1982	49	—	—
1983	49	—	4
1984	43	—	5
1985	42	13	7
1986	40	15	7
1987	38	14	7
1988	—	15	8
1989	—	15	—

— Not available.
Note: Foreign share is computed as a mean of foreign share in total assets, weighted by firm-level assets.
Source: Author's calculations.

Much of the temporal and cross-country variation in direct foreign investment appears to be induced by policy. Côte d'Ivoire has long encouraged foreign entry as a strategy for developing its manufacturing sector: foreign ownership accounted for as much as 67 percent of total assets in 1975. Morocco and Venezuela, however, restricted foreign investment in the 1970s and then reversed these policies in the 1980s. To reduce the dominant role of French firms in the Moroccan economy, the government passed the Moroccanization Decree of 1973, which restricted foreign ownership of certain industrial and commercial activities to no more than 49 percent. By the 1980s, however, Morocco was encouraging greater foreign investment by easing the restrictions on foreign investors, relaxing the rules on repatriation of capital, and simplifying the approval process for foreign investment. Venezuela discriminated against foreign firms in various ways between 1975 and 1989, including imposing higher income tax rates (50 percent compared with 35 percent for domestic firms), restricting the use of confidentiality and trade secrets in joint ventures, and restricting foreign exchange. In 1989 all of these discriminatory regulations were eliminated.

One important policy issue is the extent to which foreign investment gravitates toward oligopolistic markets or protected sectors. Helleiner

(1989, p. 1451), in reviewing the role of foreign investment in developing countries, claims that "The prospect of large and especially protected local markets are the key to most import-substituting manufacturing firms' foreign activities." To the extent that direct foreign investment is associated with protection, it can reduce national welfare by allowing rents from protected sectors to be siphoned off by foreign firms.

The literature on foreign direct investment typically also focuses on the following determinants: (1) lower wages, which make it more attractive to produce abroad, (2) intangible assets, such as managerial skills, that cannot be licensed abroad, and (3) potentially large domestic markets. Another important determinant of foreign investment is likely to be domestic regulations that restrict incoming investment to certain sectors of the economy.

To quantify the importance of these determinants for each of the three countries in our sample, the following empirical specification is adopted:

$$(7.1) \qquad DFI_{jt} = f(IMP_{jt}, H_{jt}, IMP \cdot H_{jt}, LABOR / CAPITAL_{jt}, REGUL_{jt}, MARKET\ SIZE_{jt}, WAGES_{jt}, POLLUTION_{jt}).$$

Direct foreign investment (*DFI*) is defined in two ways. First, it is defined as the share of foreign investment in total assets within each sector j at time t. Thus the equation explains the determinants of the amount of foreign investment (0 to 100 percent) *within* any one sector. Second, it is defined as (the log of) the total stock of foreign investment in a particular sector.

The independent variables, which vary across sector j and time t, include (1) import penetration (*IMP*) as a proxy for trade protection, (2) the Herfindahl index (H), equal to the sum of the square of market share of firms in each sector, as a measure of concentration, (3) the labor-capital ratio in sector j, (4) a measure of regulations (*REGUL*), which varies from 0 (no restrictions are placed on direct foreign investment) to 2 (direct foreign investment is prohibited), (5) a measure of market size, which is defined as the lagged share of sales in sector j as a percentage of total sales in manufacturing during the previous period, (6) wages in sector j and time t in France (for Côte d'Ivoire and Morocco) and the United States (for Venezuela), and (7) the costs of pollution abatement. Pollution abatement costs, measured using U.S. data on the costs of pollution abatement by sector, are included to test for the possibility that sectors with higher costs of pollution abatement in industrial countries are attracted to developing countries, where environmental regulations are less restrictive.

Equation 7.1 is estimated as a pure "between" regression, by averaging each sector's variables over time and estimating equation 7.1 as a cross

section. All standard errors are corrected for arbitrary heteroscedasticity. The results are reported in table 7.2. Statistically significant variables include the Herfindahl index, import penetration, market size, and pollution abatement costs. The single most important determinant of foreign investment appears to be the size of the market: foreign investment gravitates toward sectors with a larger share of aggregate sales. Foreign investment is also more likely to be located in less concentrated sectors and in markets with lower competition from imports. Finally, pollution abatement costs appear to play a significant role in foreign investment in Côte d'Ivoire and Morocco. Other factors, such as wages, regulations, and capital intensity in the host country, do not appear to be important. In part, the lack of statistical significance of the regulatory framework may stem from the fact that restrictions on foreign entry may only be imposed in sectors with large inflows of foreign investment.

Description of Domestic and Foreign Firms

If foreign investment is an avenue for the transfer of technology, plants with foreign equity should exhibit some type of technological superiority. This superiority should manifest itself through higher levels of productivity in firms with greater foreign participation in equity. The firm-level panel data sets permit total factor productivity to be compared across foreign and domestic firms, which is much less misleading than comparisons based on measures of partial productivity such as labor productivity (which typically varies with capital intensity).

The relative performance of foreign and domestically owned firms is measured using the following indicators: output per worker, exports as a percentage of total sales, imported inputs as a percentage of total sales, net exports (exports minus imports) as a percentage of total sales, real wages, and deviation from overall norms in the sector for multifactor productivity, as well as growth in total factor productivity. Foreign firms are defined as all firms with foreign equity that exceeds 5 percent of assets.[2] Wages are computed as the total value of remuneration to workers divided by the number of employees. The derivation of multifactor productivity and growth in total factor productivity are discussed in greater detail below.

Most performance measures in table 7.3 are reported as the ratio of the performance of foreign firms to that of domestic firms. Thus, for example, a value of 2.0 for output per worker in the food products industry in Morocco indicates that worker output is twice as high for foreign-owned firms as for domestic firms, a difference that is statistically significant at the 5 percent level. In general, the ratios of unweighted means show that foreign firms in Morocco pay higher

Table 7.2 Determinants of the Sectoral Distribution of Foreign Direct Investment in Côte d'Ivoire, Morocco, and Venezuela

	Côte d'Ivoire		*Morocco*		*Venezuela*	
Variable	*Percent DFI*	Log *DFI*	*Percent DFI*	Log *DFI*	*Percent DFI*	Log *DFI*
Herfindahl index (*H*)	−6.34 (2.95)**	−2.66 (1.99)	0.40 (3.51)	−6.69 (2.88)**	−3.76 (2.06)*	−0.04 (1.56)
Import penetration (*Imp*)	−0.25 (1.68)	−0.06 (0.90)	−1.32 (0.58)**	−2.93 (0.76)**	1.61 (2.31)	2.79 (1.26)**
Imp · *H*	6.33 (4.46)	5.05 (2.81)*	−24.96 (16.78)	−24.89 (10.14)**	1.67 (3.56)	−22.03 (8.61)**
Regulations on direct foreign investment	—	—	−0.09 (0.35)	−0.17 (0.33)	2.58 (2.58)	−0.06 (0.51)
Labor-capital ratio	0.003 (0.001)**	−0.01 (0.00)**	−0.02 (0.11)	−0.04 (0.10)	−0.74 (0.40)*	−1.78 (0.57)**
Market size	94.45 (8.59)**	32.14 (7.57)**	3.24 (19.23)	16.19 (10.46)	88.65 (26.26)**	56.59 (15.52)**
Source wage	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.0002 (0.0001)**	0.00 (0.00)	0.00 (0.00)
Cost of pollution abatement	0.54 (0.36)*	0.44 (0.19)**	2.89 (1.16)**	0.93 (0.26)**	−0.41 (0.49)	0.19 (0.19)
Number of observations	30	30	61	59	66	54
R^2	0.87	0.65	0.46	0.46	25	0.50

— Not available.
* Significant at the 10 percent level.
** Significant at the 5 percent level.
Note: Numbers in parentheses are standard errors. All standard errors were corrected for heteroscedasticity. Data for Côte d'Ivoire cover 1975–87; for Morocco, 1985–89; for Venezuela, 1983–88.
Source: Author's calculations.

Table 7.3 Productivity, Outward Orientation, and Wages: Ratios of Foreign-Owned Manufacturing Firms to Domestic Firms in Côte d'Ivoire, Morocco, and Venezuela

Country and industry	*Output per worker*	*Real wages*	*Exports as a percentage of sales*	*Imported inputs as a percentage of sales*	*Net exports*	*Total factor productivity deviation*[a]	*Total factor productivity growth*
Côte d'Ivoire							
Grain processing	0.7	0.8	8.6*	8.4*	-2.6	—	-0.4
Food processing	1.02	0.9	7.0*	1.9*	50.0*	—	-0.2
Oil	6.4*	1.9*	0.7	99.3*	-9.3	—	0.9
Other food	1.3	1.0	—	4.8*	-13.7*	—	5.1
Textiles, clothing	2.3*	1.4*	6.8*	2.0	1.6	—	-0.2
Wood products	1.6*	1.1	2.2*	—	21.0*	—	5.3
Chemicals	1.5*	0.9	0.7	1.9*	-15.4*	—	1.9
Rubber	0.5*	0.7	1.9	0.9	22.2	—	6.2
Cement	3.0	1.1*	5.5*	1.1*	-10.9*	—	-3.5
Transport	1.3	1.0	0.4	34.0	-12.1*	—	-2.2
Machinery	0.8	0.9	39.7	0.6	16.6*	—	-6.5
Paper products	1.3	1.0	2.5*	1.8*	-21.5*	—	2.6
All sectors	0.9	0.8*	3.1*	2.6*	0.0	—	-0.5
Morocco[b]							
Food products	2.0 (0.9)*	2.3 (1.2)*	15.2 (4.5)*	—	—	0.7 (0.7)*	-6.4
Other food	0.5 (0.5)	1.2 (1.1)	20.0 (2.7)*	—	—	1.0 (1.3)	-7.3
Beverages, tobacco	1.4 (0.6)*	2.2 (1.4)*	10.8 (9.6)*	—	—	0.9 (4.0)	-7.0
Textiles	1.1 (0.5)	0.9 (0.2)	1.5 (0.7)*	—	—	0.9 (1.0)	0.0
Apparel	0.8 (1.1)	1.3 (1.4)*	1.8 (1.1)*	—	—	0.9 (1.0)	-12.3*

(Table continues on the following page.)

Table 7.3 (continued)

Country and industry	*Output per worker*	*Real wages*	*Exports as a percentage of sales*	*Imported inputs as a percentage of sales*	*Net exports*	*Total factor productivity deviation*[a]	*Total factor productivity growth*
Morocco[b] (continued)							
Leather products	1.1 (0.6)	2.0 (1.8)*	2.3 (1.4)*	—	—	1.0 (1.0)	0.3
Wood products	1.2 (1.0)	1.6 (1.0)*	8.5 (6.3)*	—	—	0.8 (0.8)*	−64.7
Paper products	1.5 (0.6)*	1.7 (1.3)*	11.7 (30.7)*	—	—	0.9 (0.4)*	14.0
Nonmetallic minerals	2.3 (2.2)*	1.9 (2.2)*	6.1 (1.6)*	—	—	0.7 (0.5)*	4.4
Basic metals	1.0 (0.3)	1.9 (1.2)*	0.2 (0.1)*	—	—	1.3 (21.2)	−0.3
Metal products	0.6 (0.5)	1.1 (1.1)	4.0 (2.3)*	—	—	1.0 (0.8)	−1.5
Machinery	1.1 (2.2)	0.8 (1.8)	5.0 (0.2)*	—	—	0.9 (0.7)	−1.8
Transport equipment	1.6 (2.0)*	2.0 (2.1)*	1.6 (0.4)	—	—	0.8 (0.7)*	9.7
Electronics	1.5 (1.3)*	2.1 (2.0)*	4.5 (3.9)*	—	—	0.8 (0.8)*	0.3
Scientific instruments	1.3 (1.7)*	1.7 (1.8)*	0.3 (0.1)	—	—	1.0 (1.1)	16.2
Chemicals	2.0 (0.6)*	2.6 (1.8)*	1.9 (0.0)*	—	—	0.7 (1.9)*	1.1
Rubber	0.9 (1.8)	1.5 (3.8)	4.2 (3.6)*	—	—	0.9 (0.8)*	−1.3
Other manufacturing	0.9 (0.8)	0.6 (0.8)	0.6 (0.5)	—	—	1.1 (1.0)	−21.3
All sectors	1.2 (0.7)	1.7 (1.3)*	2.0 (0.7)*	—	—	0.9 (0.9)*	−6.7*

Venezuela							
Food, beverages	2.0*	2.0*	0.7	4.4*	10.2*	9.1*	—
Textiles, apparel, leather	1.4*	1.2*	3.5	1.6	−0.2*	9.9*	—
Wood products	1.4*	1.7*	0.0	1.7	−0.2*	9.5	—
Paper products	2.2*	1.4*	5.5*	1.2	−7.1*	8.0*	—
Chemicals	1.4*	1.4*	3.5*	1.6	−7.1*	—	—
Nonmetallic minerals	1.7*	1.7*	7.0*	4.3*	−2.6*	14.7*	—
Basic metals	1.6*	1.3	8.3*	2.6*	18.8*	0.0	—
Machinery, metal products	1.7*	1.4*	10.9*	3.2*	−10.3*	7.7*	—
Other manufacturing	1.6*	1.4*	0.6	3.6*	−13.5*	—	—
All sectors	1.7*	1.6*	8.4*	2.9*	6.9*	8.5*	2.7*

— Not available.

* Statistically significant at the 5 percent level.

Note: A firm is defined as foreign if more than 5 percent of total assets are foreign owned. Data for Côte d'Ivoire cover 1975–87; for Morocco, 1985–89; for Venezuela, 1983–88.

a. Data for Morocco are ratios of the average deviation of the productivity of foreign firms from best practice to average deviation of the productivity of domestic firms. A value of less than 1 indicates less deviation from best practice among foreign firms. Data for Venezuela are coefficients on the participation of foreign equity in a production function specification. A positive coefficient indicates that foreign equity raises productivity.

b. For Morocco the first number in each cell is a ratio of unweighted means; the numbers in parentheses are weighted by size of the firm.

Source: Author's calculations.

wages, export a higher share of output, and exhibit higher labor productivity, although the difference in labor productivity is not significant in the aggregate.[3]

The pattern is similar for Côte d'Ivoire and Venezuela. Joint ventures in the two countries tend to export more than their domestic counterparts, but only in Venezuela do foreign firms exhibit higher labor productivity and pay higher wages. In both countries, foreign firms have a much higher propensity to import—their ratios of imports to sales are almost three times higher than those of domestic plants in the same sector. Differences in net exports (exports minus imports) are also compared as a share of total sales. The difference in net exports across foreign and domestic firms varies significantly in both size and magnitude across different sectors for Côte d'Ivoire and Venezuela. For all sectors together, however, there is no difference in net exports generated by foreign versus domestic firms in Côte d'Ivoire and a difference of only 6.9 percent in Venezuela. Foreign firms in Côte d'Ivoire also import significantly more than their domestic counterparts.

Deviations in total factor productivity—which takes into account the combined productivity of the firm when all inputs are included—are calculated from estimates of total factor productivity by Haddad and Harrison (1993) for Morocco and by Aitken and Harrison (1994) for Venezuela. Haddad and Harrison compute a firm-specific level of total factor productivity that is essentially the firm-level residual in a production function estimation. They then compute efficiency at the firm level relative to the most efficient firm in each sector. Given N firms, there will be N estimated productivity measures within each sector j, given by $\hat{a}_{1j}, \ldots, \hat{a}_{Nj}$. Relative efficiency for firm i is given by z_{ij}, where

$$\begin{aligned} &\hat{a}_j = \max(\hat{a}_{ij}) \\ &z_{ij} = \hat{a}_{ij} - \hat{a}_j, \\ &i = 1, 2, \ldots, N \text{ for each sector } j. \end{aligned} \tag{7.2}$$

A large negative value for z_{ij} indicates that firm i is very inefficient relative to the most efficient firm in sector j. A ratio of less than unity in table 7.3 indicates that foreign firms are relatively more productive than their domestic counterparts, since the deviation z_{ij} from the best-practice firm is low. Both weighted and unweighted means for the deviations show that, on average, foreign firms in Morocco have achieved a higher level of productivity than domestic firms.

Aitken and Harrison (1994) also compare the level of total factor productivity across foreign and domestic firms in Venezuela, but the approach is slightly different. They estimate a Cobb-Douglas production function in levels for each sector: output is expressed as a function of

Venezuela							
Food, beverages	2.0*	2.0*	0.7	4.4*	10.2*	9.1*	—
Textiles, apparel, leather	1.4*	1.2*	3.5	1.6	–0.2*	9.9*	—
Wood products	1.4*	1.7*	0.0	1.7	–0.2*	9.5	—
Paper products	2.2*	1.4*	5.5*	1.2	–7.1*	8.0*	—
Chemicals	1.4*	1.4*	3.5*	1.6	–7.1*	—	—
Nonmetallic minerals	1.7*	1.7*	7.0*	4.3*	–2.6*	14.7*	—
Basic metals	1.6*	1.3	8.3*	2.6*	18.8*	0.0	—
Machinery, metal products	1.7*	1.4*	10.9*	3.2*	–10.3*	7.7*	—
Other manufacturing	1.6*	1.4*	0.6	3.6*	–13.5*	—	—
All sectors	1.7*	1.6*	8.4*	2.9*	6.9*	8.5*	2.7*

— Not available.

* Statistically significant at the 5 percent level.

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& i = 1, 2, \ldots, N \text{ for each sector } j.
\end{aligned}
$$

A large negative value for z_{ij} indicates that firm i is very inefficient relative to the most efficient firm in sector j. A ratio of less than unity in table 7.3 indicates that foreign firms are relatively more productive than their domestic counterparts, since the deviation z_{ij} from the best-practice firm is low. Both weighted and unweighted means for the deviations show that, on average, foreign firms in Morocco have achieved a higher level of productivity than domestic firms.

Aitken and Harrison (1994) also compare the level of total factor productivity across foreign and domestic firms in Venezuela, but the approach is slightly different. They estimate a Cobb-Douglas production function in levels for each sector: output is expressed as a function of

materials, skilled labor, unskilled labor, dummy variables for each year, and foreign ownership. The coefficient on foreign ownership can be interpreted as the percentage difference in productivity between foreign and domestic firms. In Venezuela, as in Morocco, plants with foreign equity participation consistently exhibit higher levels of total factor productivity. These results suggest that firms with foreign equity participation exhibit some sort of technological superiority in these countries. They also suggest that a complete explanation of sectoral productivity must begin with a framework flexible enough to recognize heterogeneity among producers. (See chapter 3 of this volume for studies of this type.)

Do foreign firms also dominate the growth of productivity? Although firms with foreign equity exhibit faster growth of total factor productivity than domestic firms in Venezuela, the reverse is found in Morocco, and the difference is insignificant for firms in Côte d'Ivoire. This result is not particularly surprising. Although foreign firms are expected to exhibit higher levels of productivity, their rate of growth of productivity is expected to be lower than that of domestic firms that are catching up to the higher levels of productivity of their foreign counterparts.

Testing for Spillovers of Technology from Foreign Investment

The comparisons presented so far suggest that in Morocco and Venezuela firms with foreign ownership exhibit a technological edge. This section examines whether any of this technological advantage spills over to domestic firms. If the knowledge or new technology embodied in foreign firms or joint ventures is transmitted to domestic firms, then the productivity of domestic plants (measured in levels or growth rates) should be higher in sectors with a large foreign presence. We first turn to an examination of the relationship between spillovers of technology and the level of domestic productivity using Moroccan data. We then examine the impact, using both the Moroccan and Venezuelan data, of foreign investment on the growth rate of domestic productivity.

Spillovers and the Level of Productivity

Haddad and Harrison (1993) examine the impact of direct foreign investment on dispersion in the level of productivity for Morocco. The findings on spillover effects—the extent to which the presence of direct foreign investment increases the rate of productivity growth, after accounting for other factors—show some evidence that direct foreign investment moves domestic plants toward greater efficiency in Morocco. In Venezuela, plants in sectors with heavy direct foreign investment appear to do better. However, when industry effects are included, direct

foreign investment no longer appears to generate positive spillovers; if anything, the effect is negative. Essentially, this means that short-run temporal variation in direct foreign investment does not improve the productivity of domestic plants, possibly because multinational corporations take market share from domestic plants, thereby reducing their capacity utilization.

Haddad and Harrison use a modified version of the z_{ij} term defined in equation 7.2. Normalizing the productivity terms so that they can be compared across different sectors requires one more step. Given N firms, there will be N estimated productivity terms within each sector j, given by $\hat{a}_{1j}, \ldots, \hat{a}_{Nj}$. Thus, u_{ij}, the deviation of firm-level productivity from the best-practice level for the sector, can be defined as follows:

$$\hat{a}_j = \max(\hat{a}_{ij}) \tag{7.3}$$

$$u_{ij} = (\hat{a}_{ij} - \hat{a}_j) / \hat{a}_j,$$

$$i = 1, 2, \ldots, N \text{ for each sector } j, \text{ where all } u_{ij} < 0.$$

The dispersion of productivity across firms in sector j can then be examined, using the following equation, which controls for size of the firm:

$$u_{ij} = f(DFI\text{-}Firm_{ij}, DFI\text{-}Sector_j, SIZE_{ij}). \tag{7.4}$$

DFI-Firm is the share of foreign assets in each firm's total assets, *DFI-Sector* is the share of foreign firms (as measured by firm-level assets) in the sector, and *SIZE* is a measure of the size of the firm, proxied by the ratio of firm-level sales to total sales for the largest firm in each sector.

The results show a positive and statistically significant coefficient on the share of each firm's assets that are foreign owned (see table 7.4), which is consistent with the results showing less deviation from levels of best-practice productivity in plants with foreign equity participation (table 7.3). The positive and significant coefficient on size also suggests that larger firms are more likely to achieve higher levels of productivity than smaller firms. The positive and significant coefficient on sectoral foreign investment—a measure of the impact of foreign presence on the deviation of productivity from best-practice levels—suggests a smaller deviation in sectors with more foreign investment. The coefficient of 0.17 on sectoral direct foreign investment (*DFI-Sector*) indicates that an increase by one standard deviation in foreign share would bring a firm 4 percent closer to best practices.

Market structure and trade policy variables are introduced to test the sensitivity of these results (column 3 in table 7.4). The Herfindahl index is included to capture the effects of industry-level concentration, and

Table 7.4 Impact of Foreign Ownership on Firm-Level Productivity in Morocco

		Domestically owned firms	
Variable	*All firms*	*Without market structure variables*	*With market structure and trade policy variables*
Intercept	−0.441 (0.004)	−0.444 (0.004)	−0.295 (0.023)
DFI-Firm	0.030 (0.008)	n.a.	n.a.
DFI-Sector	0.170 (0.019)	0.174 (0.022)	0.109 (0.023)
Size of firm	0.002 (0.00001)	0.002 (0.0001)	0.002 (0.0001)
Tariffs (*Tar*)	n.a.	n.a.	−0.092 (0.043)
Nontariff barriers (*NTB*)	n.a.	n.a.	−0.008 (0.001)
Tar · NTB	n.a.	n.a.	0.009 (0.001)
Herfindahl index	n.a.	n.a.	0.116 (0.021)
Number of firms	3,933	3,105	3,105
R^2	0.16	0.12	0.19

n.a. Not applicable.

Note: Numbers in parentheses are standard errors. The dependent variable is the deviation of firm-level productivity from sector-level best practices. Data cover 1985–89.

Source: Haddad and Harrison 1993, table 4. Reprinted with kind permission of Elsevier Science-NL, Amsterdam.

average tariffs and coverage of quantitative import restrictions by sector for 1984–87 are included to capture differences in protection across industries. When these variables are included, the coefficient on foreign share drops slightly but remains positive and statistically significant. The negative coefficients on tariffs and nontariff barriers suggest that greater protection is associated with a movement of plants away from best practices. An interaction term for trade policy variables is also included to allow for the possibility that the impact of any one trade policy instrument is mitigated if used in conjunction with another.

Extending to Venezuela the approach taken for Morocco provides a means of examining the robustness of the finding on spillovers in the level of productivity. Aitken and Harrison (1994) examine Venezuelan data for a panel of firms, employing a production function that is slightly different than the Moroccan one because the data are richer. Data for Venezuela include information on material inputs (M) and skill categories of workers (SKL and $UNSKL$).

$$Y_{ijt} = A_{ijt}F(SKL_{ijt}, UNSKL_{ijt}, M_{ijt}, K_{ijt}) \tag{7.5}$$

where Y is total production and A is level of productivity, which is assumed to vary across firms in each sector j over time t. The log-level

specification is derived by assuming a Cobb-Douglas production function, yielding

$$\log Y_{ijt} = \log A_{ijt} + a_1 \log SKL_{ijt} + a_2 \log UNSKL_{ijt} + a_4 \log M_{ijt} + a_5 \log K_{ijt}. \tag{7.6}$$

In contrast to the analysis for Morocco, the analysis for Venezuela examines only the impact of foreign investment on domestic firms, excluding from the sample all firms with some foreign ownership. The analysis imposes a common production technology across sectors (up to the intercept), rather than estimating coefficients on factor stock industry by industry.

To decompose productivity into several components, Aitken and Harrison assume that

$$\log A_{ijt} = \text{Constant} + b\ DFI\text{-}Sector_{jt} + cC_j + dD_t + e_{it} \tag{7.7}$$

where C_j and D_t are dummy variables for sector and time. Combining equations 7.6 and 7.7 yields the estimating equation

$$\log Y_{ijt} = \text{Constant} + b\ DFI\text{-}Sector_{jt} + cC_j + dD_t + a_1 \log SKL_{ijt} + a_2 \log UNSKL_{ijt} + a_4 \log M_{ijt} + a_5 \log K_{ijt} + e_{it}. \tag{7.8}$$

Some versions of this model omit the C_j dummy variable for sectors. When included, these dummies take out all time-invariant, industry-specific productivity effects. Any residual correlation between direct foreign investment and productivity is therefore due to industry-specific temporal fluctuations.

The estimations that omit industry-specific effects essentially replicate earlier tests of the spillover hypothesis (Globerman 1979; Blomstrom and Persson 1983). Because of data limitations, these studies estimate the impact of foreign investment using cross-sectional data, relying on differences across sectors to identify the effects of foreign investment. Without corrections for industry effects, the results for Venezuela yield plausible coefficients on all inputs, all of which are positive and statistically significant (see table 7.5). The coefficient on the share of foreign ownership in the sector (*DFI-Sector*) is also positive and significant, with a point estimate of 0.061 that is in the same range as results obtained in earlier work. That estimate suggests that if the share of labor employed by foreign-owned firms rises from 0 to 10 percent of the manufacturing sector, output increases 0.6 percent. Since the estimation controls for increases in inputs, this 0.6 percent increase is a pure gain in total factor productivity.

Table 7.5 Impact of Sectoral Foreign Investment on the Productivity of Domestic Firms in Venezuela

Variable	Without industry dummy variables	With industry dummy variable	
		At two-digit level	At four-digit level
Material (*M*)	0.569 (0.002)	0.573 (0.002)	0.585 (0.002)
Capital (*K*)	0.084 (0.001)	0.076 (0.002)	0.060 (0.002)
Unskilled labor (*UNSKL*)	0.296 (0.003)	0.293 (0.003)	0.293 (0.003)
Skilled labor (*SKL*)	0.110 (0.002)	0.114 (0.003)	0.108 (0.003)
Foreign presence in sector (*DFI-Sector*)	0.061 (0.032)	−0.028 (0.031)	−0.223 (0.059)

Note: Numbers in parentheses are standard errors. The dependent variable is the log output produced by domestically owned firms, which are defined as firms that have no foreign ownership over the entire sample period. All regressions include annual time dummy variables. Data cover 35,514 observations during 1983–88.

Source: Aitken and Harrison 1994.

But if foreign firms tend to locate in the more productive sectors, estimates of the impact of foreign share are biased upward. One way to correct for this is to introduce sector dummy variables that control for differences in productivity across industries that are due to unobserved factors, using the variation over time within industries to identify the impact of foreign investment. When the model is estimated with dummy variables for industries at the two-digit level, the coefficient on direct foreign investment switches from positive to negative and becomes statistically insignificant. This change suggests that the positive and statistically significant impact of foreign investment that is obtained when using cross-industry data is not robust: it is impossible to distinguish the possibility that foreign investment has positive spillovers on productivity in domestic firms from the possibility that foreign firms simply locate in productive industries.

Including dummy variables at the two-digit industry level may not entirely remove the type of bias discussed above, because foreign investment may be attracted to the most productive subsectors within an industry. To test for this possible bias, Aitken and Harrison (1994) estimate the equation again with industry dummies at the four-digit level.[4]

The impact is dramatic. The coefficient on direct foreign investment becomes even more negative (from −0.028 to −0.22) and is significant at the 1 percent level. The coefficient of −0.22 suggests that an increase in the share of foreign investment from 0 to 10 percent of manufacturing would be accompanied by a *decline* in total factor productivity of 2.2 percent. This negative spillover is consistent with several alternative models of foreign entry. Aitken and Harrison (1994) present a model in which foreign entry reduces the demand for domestically owned pro-

duction, driving up the average costs of domestic firms. Another possibility is that foreign firms draw away the best workers or locate in areas with the best infrastructure, restricting access to domestic competitors and thereby reducing their productivity. Another plausible explanation is that productive industries are also profitable industries, so that foreign direct investment simply fulfills an equilibrating role in the world economy. The demand-side interpretation is appealing, because correlations based on temporal variation in the data are likely to reflect movement along short-run cost curves, while cross-sectional correlations come closer to long-run effects.[5]

The finding of negative spillovers contrasts with earlier findings in the literature and calls into question the existence of a positive transfer of technology through foreign entry, at least in the Venezuelan case. Foreign investment could also be associated with declining productivity in the aggregate, while still conveying substantial benefits to nearby plants. To examine the impact of locating in an area with a high share of foreign investment, Aitken and Harrison depart from previous research by allowing foreign share to vary across both industries (j) and regions (s). The productivity term A can now be specified as:

$$\log A(s)_{ijt} = \text{Constant} + b_1 DFI\text{-}Sector_{jt} + b_2 DFI\text{-}Local(s)_{jt} + L(s)_t + cC_j + dD_t + e_{it} \tag{7.9}$$

where the location-specific productivity term $L(s)_t$ varies across regions and over time, but not across industries. If $L(s)_t$ is positively correlated with foreign share, the coefficient on *DFI-Local* overestimates the impact of location-specific foreign investment on productivity. For example, if foreign firms are more attracted to regions that benefit from agglomeration economies, analysis shows a correlation between domestic productivity and foreign share in a particular location even in the absence of spillovers.

Variations in productivity due to agglomeration economies or other region-specific effects are captured by the log of the real wage for skilled labor ($\log Wage_{st}$) and region-specific price of electricity ($\log Elecp_{st}$). Rauch (1991) provides empirical evidence for the United States that variation in the accumulation of human capital across cities is reflected in higher wages for individuals. Energy prices are included here, because the government of Venezuela explicitly encourages firms to locate in some regions by offering special energy subsidies in those regions.

These variables are included as proxies for $L(s)_t$, which cannot be observed. Because foreign investment in any one four-digit industry is unlikely to affect significantly the skilled wage for all industries in the region, the skilled wage is independent of the *DFI-Local* variable. Combining equations 7.9 and 7.6 yields

$$(7.10)\quad \log Y_{ijt} = \text{Constant} + a_1 \log SKL_{ijt} + a_2 \log UNSKL_{ijt} + a_4 \log M_{ijt} + a_5 \log K_{ijt} + b_1 DFI\text{-}Sector_{jt} + b_2 DFI\text{-}Local_{sjt} + b_3 \log Wage_{st} + b_4 \log Elecp_{st} + cC_i + dD_t + e_{it}.$$

Foreign share, electricity prices, and the wage for skilled labor are calculated at the district level. Venezuela's twenty-three regions together contain 220 districts covering an average of 1,600 square miles. If skilled wages and electricity prices can capture only imperfectly regional agglomeration economies that are fixed over time, estimates for coefficients on foreign investment at the local level could still be inconsistent. Consequently, equation 7.10 is estimated using a within transformation of the data at the regional level, computed by subtracting from each variable its region-sector mean over time.

The results show that direct foreign investment at the sectoral level continues to have a negative and statistically significant impact on the productivity of domestic plants for both classes of plants (see table 7.6). This negative impact is consistent across subsectors. At the local level, however, there is some evidence of positive spillovers in sectors such as wood products and pottery and glass. Across all sectors, *DFI-Local* has essentially no impact on plant-level productivity.

Alternative specifications that allow for dynamic effects (by including lags of direct foreign investment) or that employ dummy variables as an alternative definition of foreign presence yield similar results. Sectoral foreign investment has a negative and significant impact on productivity. At the local level, foreign investment generally has no positive spillover on domestic firms. Nevertheless, we must be cautious in interpreting these

Table 7.6 Combined Regressions of Sectoral and Regional Foreign Share for Venezuela: Within Estimates

Sector	*Sectoral foreign share*	*Regional foreign share*
Food products	−0.395 (0.096)	0.062 (0.077)
Textiles and clothing	−0.032 (0.320)	−0.196 (0.163)
Wood products	−1.511 (0.687)	0.637 (0.220)
Paper and publishing	0.179 (0.448)	0.007 (0.100)
Pottery and glass	−0.158 (0.198)	0.485 (0.167)
Basic metals	0.283 (0.236)	0.056 (0.187)
Machines and equipment	−0.132 (0.110)	−0.052 (0.087)
All industries	−0.217 (0.062)	−0.014 (0.047)

Note: The dependent variable is the log output produced by domestically owned firms, defined as firms that have no foreign ownership over the entire sample period. All regressions include annual time dummy variables, the overall skilled wage in the region, and price of electricity. Numbers in parentheses are standard errors. Data cover 34,236 observations during 1983–88.

Source: Aitken and Harrison 1994.

Table 7.7 Impact of Foreign Investment on Productivity Growth in Morocco, by Level of Protection

Variable	All firms	Tariffs		Quotas		Reduction in quotas	
		Low	High	Low	High	Low	High
d log *L*	0.770	0.752	0.767	0.725	0.779	0.778	0.762
	(0.009)	(0.025)	(0.016)	(0.023)	(0.016)	(0.012)	(0.013)
d log *K*	0.088	0.077	0.070	0.061	0.076	0.081	0.100
	(0.011)	(0.035)	(0.019)	(0.025)	(0.022)	(0.014)	(0.018)
DFI-Firm	–0.020	–0.011	–0.039	0.022	–0.073	–0.025	–0.011
	(0.023)	(0.054)	(0.041)	(0.044)	(0.048)	(0.028)	(0.040)
DFI-Sector	–0.039	–0.005	–0.139	–0.191	–0.012	–0.035	–0.083
	(0.061)	(0.134)	(0.127)	(0.135)	(0.128)	(0.077)	(0.100)
R^2	0.42	0.38	0.39	0.33	0.41	0.42	0.40
Number of observations	11,772	1,585	4,212	2,154	3,643	6,402	5,370

Note: The dependent variable is the change in log value added. All equations include time dummies and sector dummies at the two-digit level. Numbers in parentheses are standard errors. Data cover 1985–89.

Source: Haddad and Harrison 1993, table 7. Reprinted with kind permission of Elsevier Science-NL, Amsterdam.

findings. The results suggest that short-run temporal variation in direct foreign investment does not positively influence the productivity of domestic plants, possibly because multinational corporations take market share from domestic plants, thereby reducing their capacity utilization. The only exceptions are domestic firms that are foreign owned at some time during the sample period. For these firms, the positive impact of foreign presence can be large and significant, depending on the specification.

Spillovers and Productivity Growth

An alternative way to study temporal fluctuations is to convert the data on level of productivity to rate of productivity growth. Haddad and Harrison (1993) do this for the panel of Moroccan data, beginning with a production function, with value added Y as a function of two inputs, capital and labor:

$$Y_{ijt} = A_{ijt}F(L_{ijt},K_{ijt}). \tag{7.11}$$

The level of productivity is given by A_{ijt}, which is assumed to vary across firms within each sector j and across time t. Totally differentiating this equation and assuming that each factor is paid the value of its marginal product yields the following equation (in logs):

$$d\log Y_{ijt} = (dA / A_{ijt}) + a_1 d\log L_{ijt} + a_k d\log K_{ijt} \tag{7.12}$$

where dA / A is growth in productivity. The coefficients on growth in labor and capital are simply their shares in value added. To test the hypothesis that growth in productivity is affected by the share of foreign investment, productivity growth is decomposed into the following components:

$$dA / A_{ijt} = a\textit{DFI-Firm}_{ijt} + b\textit{DFI-Sector}_{jt} + cC_j + dD_t. \tag{7.13}$$

Productivity growth varies across sectors j and time t and as a function of the level of foreign investment in both firms and sectors. The coefficient on *DFI-Sector* measures positive spillover. Combining equations 7.12 and 7.13 yields

$$\begin{aligned} d\log Y_{ijt} = {} & a\textit{DFI-Firm}_{ijt} + b\textit{DFI-Sector}_{jt} + cC_j + dD_t \\ & + a_1 d\log L_{ijt} + a_k d\log K_{ijt}. \end{aligned} \tag{7.14}$$

At the firm level, the impact of foreign investment is negative but statistically insignificant, indicating that growth in productivity is lower among foreign firms than among domestically owned firms, although the difference is not significant (see table 7.7). If domestic firms exhibit higher growth of productivity than foreign-owned firms, could this

catch-up be due to spillovers from foreign investment? The sign on *DFI-Sector* is negative, but insignificant, providing no evidence for positive spillovers from direct foreign investment.[6]

The lack of evidence on positive spillovers from foreign investment could be due to distortions in the trade policy regime. If foreign firms are attracted to highly protected domestic markets, the results presented in column 1 of table 7.7 could suffer from bias caused by omitted variables so that the coefficient on foreign investment is underestimated if protected sectors exhibit low productivity growth.

To examine the impact of protection on potential spillovers from foreign investment, the sample is split into low- and high-protection groups, using three measures of protection. The first measure of protection is the average tariff level by three-digit sector for the three years for which it is available (1984, 1987, and 1988). The second measure is the share of production subject to quantitative restrictions. The third is the change in quota coverage between 1984 and 1988. The coefficient on *DFI-Sector* is insignificant and negative, once again suggesting that positive spillovers of technology are absent in the short run. The coefficient on *DFI-Firm* is significantly negative only in the protected sectors, suggesting that foreign firms exhibit lower productivity growth relative to domestic firms only in protected sectors.

Trade Reform, Productivity, and Ownership in Côte d'Ivoire

The preceding section found little evidence that technology spills over from foreign to domestic firms in Morocco or Venezuela, although the participation of foreign equity conveys clear benefits to joint ventures in the form of higher productivity. These results suggest that whatever gains in technology occur through foreign investment are captured entirely by joint ventures. Another potential gain is that the participation of foreign equity may ease the transition to a more open economy. Firms with foreign equity may be better prepared, through easier access to information and outside capital, to make the transition under trade liberalization. This section tests that possibility using data for Côte d'Ivoire in an estimating equation that extends the approach taken by Hall (1988) and Domowitz, Hubbard, and Petersen (1988), as described by Harrison (1994).

A modified production function for firm i in sector j at time t is given by

$$(7.15) \qquad (dy - de)_{ijt} = B_{0j} + B_{1j}\,[dx - (a_l + a_m)de]_{ijt} + B_{2j}\,\{D[dx - (a_l + a_m)de]\}_{ijt} + B_{3j}\,D + B_{4j}\,dk_{ijt} + (df_{it}/f_{it}) + u_{it}\,.$$

Lower-case variables y, l, m, and e are equal to $\ln(Y / K)$, $\ln(L / K)$, $\ln(M / K)$, and $\ln(E / K)$; Y, L, M, E, and K are firm-specific output, labor, material inputs, energy consumption, and capital stock. The extent to which the coefficient B_1 exceeds unity is a measure of market power, while $1 - B_4$ measures returns to scale. The term df_{it} / f_t is a firm-specific effect in the growth rate.

A dummy variable D is included in equation 7.15 to account for changes in behavior and productivity during the trade reforms of 1985–87. If productivity increases during the reform, coefficient B_3 should be positive, while if trade reform increases the competitive behavior of firms, coefficient B_2 should be negative, reflecting the fall in markups when firms are exposed to international competition.

Three different measures of changes in trade policy are used: a simple before-and-after comparison (using the dummy variable D), import penetration, and tariffs. The sample is split into foreign, public sector, and private firms. When openness is measured using the before-and-after comparison, coefficient B_3 is positive and significant only for foreign firms, signifying that productivity in foreign firms reacts more positively to liberalization (see table 7.8). Results using import penetration and tariffs are generally insignificant.

The markups of foreign and domestic firms respond differently to changes in tariffs, but not much differently to greater import penetration. In markups, foreign firms do not gain as much from higher tariffs as do domestic public and private firms and gain only slightly more from greater import penetration. Overall, the results suggest that increased openness does not greatly affect the markup behavior of foreign firms, but it does encourage foreign firms to increase productivity more than other firms.

Conclusions

According to Helleiner (1989), the neoclassical approach to foreign investment stresses the possible benefits generated through favorable externalities, particularly through technological diffusion and training. Yet, as Helleiner points out, "Research upon the less direct provision of extra inputs to the host country—through training, the local diffusion of knowledge, and technology, etc.—has been fairly limited and anecdotal" (p. 1455). Other approaches to the analysis of foreign investment stress its presence in oligopolistic and protected markets, where multinational corporations can exploit their firm-specific assets. Until now, opportunities to test these theories have been extremely limited, primarily because of the paucity of disaggregate data. The empirical results presented here are a first step to research some of these issues with micro data.